UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/629,877	07/29/2003	Mahmoud K. Jibbe	03-0272	5581

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EXAMINER
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ART UNIT	PAPER NUMBER
2188	

DATE MAILED: 09/06/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

	Application No.	Applicant(s)
Office Action Summary	10/629,877	JIBBE, MAHMOUD K.
	Examiner	Art Unit	
	Duc T. Doan	2188	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *15 June 2006*.

2a)☒ This action is **FINAL**.   2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-12 and 14-29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12 and 14-29* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *29 July 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All   b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☐ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4)☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5)☐ Notice of Informal Patent Application (PTO-152)

6)☐ Other: _____.

DETAILED ACTION

Status of Claims

Claims 1-27 have been presented for examination in this application. In response to the last office action, claims 10,14 have been amended, claim 13 has been canceled. As the result, claims 1-12,14-27 are now pending in this application.

Claims 1-12,14-27 are rejected.

Applicant's arguments filed 6/15/06 have been fully considered but they are not persuasive. Therefore, the rejections from the previous office action are respectfully maintained with changes as needed to address the amendments.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-2,4,8-9 rejected under 35 U.S.C. 103(a) as being unpatentable over Sawdy et al

(US 6351831) in view of Rauscher (US 6874100) and further in view of Cruyningen (US Pub

2002/0019897).

As in claim 1, Sawdy describes a storage array network, comprising: a first and second

storage array controller module (Fig 2: #210,212), wherein each storage array controller module

has a first and second array controller unit; and an array of storage devices (Fig 5: #70), wherein

the first storage array controller module is a primary storage array controller that normally

performs storage array controller functions and the second storage array controller module is a

redundant back up (Sawdy's column 1 lines 1-20);

The claim further recites wherein the first array controller module provides an availability

signal to the second storage array controller module, wherein if the second array controller

module does not receive a signal from the first storage array controller module within a given

period of time, the second storage array controller module asserts control over the array of

storage devices. Sawdy does not describe the claim's aspect of "heartbeat" signal between the

storage array controller modules. However, Rauscher describes an active RAID system with

multiple controllers in which the controllers are communicating with each other via "heartbeat"

connections (Rauscher's column 2 lines 56-68). It would have been obvious to one of ordinary

skill in the art at the time of invention to include the heartbeat connect as suggested by Rausner

in Sawdy' system to inform each controller the status of the other controller, and thereby

allowing the other controller quickly take over the failed controller automatically (Rausner's

column 2 lines 5-15, lines 57-68). Sawdy and Rauscher do not expressly disclose the claim's

detail of first and second array controller units. However Cruyningen describes a storage array

configuration (Cruyningen's Fig 7) in which multiple disks units (Cruyningen's Fig 7 disks in

unit 20a and disks in unit 20b) are grouped and controlled by the controller Fig 7: #10a. It would

have been obvious to one of ordinary skill in the art at the time of invention to include grouping

disks into units as suggested by Cruyningen in Sawdy' system such that devices can be easily

managed; for example an additional unit of storage being added into an existing storage channel

partition (Cruyningen's page 3 paragraph 42).

As in claims 2,4, the claims recites a storage array switch electrically connected between

the first and second storage array controller modules and the array of storage devices (claim 2);

first and second interface switches and first and second host devices electrically connectable to

the first and second storage array controller modules through the first and second interface

switches (claim 4); Sawdy's Fig 4 describes the multiples controllers are connecting to multiple

disk arrays with multiple "switches" hubs (Fig 4: #400, #402).

As in claim 8-9, Sawdy describes wherein redundancy and drive control is accomplished

through multiple storage array controller modules (claim 8); wherein, if one of the storage array

controller modules fails, another storage array controller module assumes control (claim 9).

Sawdy's column 1 lines 1-10, column 2 lines 1-25.

Claim 3 rejected under 35 U.S.C. 103(a) as being unpatentable over Sawdy et al (US

6351831), Rauscher (US 6874100), Cruyningen (US Pub 2002/0019897) as applied to claim 2

and further in view of Brocade (Quick loop data sheet).

As in claim 3, Sawdy, Rauscher, Cruyingen do not expressly disclose the claim's aspect

of the switch as a Fibre Channel quick loop switch. However, Brocade teaches of using the Fibre

Channel Quick loop as an alternative to a hub-based solution (Brocade's column 1, lines 1-15). It

would have been obvious to one of ordinary skill in the art at the time of invention to include a

Fibre Channel Quick Loop as an alternative to a hub-based solution as suggested by Brocade, in

Sawdy' system thereby further allowing the storage system to achieve superior performance and

fault management (Brocade's column 1,lines 1-15).

Claims 5-7 rejected under 35 U.S.C. 103(a) as being unpatentable over Sawdy et al (US

6351831), Rauscher (US 6874100), Cruyningen (US Pub 2002/0019897) as applied to claim 1

and further in view of Deng (US 6937608).

As in claims 5-7, the claims recite wherein the first array controller units of the first and

second storage array controller modules are grouped together into a first multicast group (claim

5); wherein a host broadcasts a command to the first multicast group (claim 6); wherein frames

for the first array controller unit of the first storage array controller module are forwarded to the

first array controller unit of the second storage array controller module (claim 7);

Sawdy describes each controller has tables to keep tracks of the mapping of devices in

the storage system (such as device addresses, port name, I/O ports, Sawdy's column 3), Thus by

using the maps, a controller can "forwarding" the requests from hosts to the proper device

(Sawdy's column 2 lines 4-26; Cruyningen further describes the commands to disks are

preferred managed as a "group" unit; Cruyningen's page 3 paragraph 42). Sawdy, Raushner,

Cryningen do not expressly disclose the claim's aspect of a multicast group. However, Deng

describes a method for a switch to forwarding a packet to only ports in the multicast group. It

would have been obvious to one of ordinary skill in the art at the time of invention to include

switch forwarding scheme as suggested by Deng in Sawdy's system to reduce network traffic thereby allowing the switch to be used for a multiple multicast streams (Deng's column 3 lines 1-10, lines 50-60).

Claims 10-12,14-18,20,22-27 rejected under 35 U.S.C. 103(a) as being unpatentable over Sawdy et al (US 6351831), Rauscher (US 6874100), Cruyningen (US Pub 2002/0019897) and further in view of Workman et al (US Pub 2004/0068591), Jantz (US 5944838).

As in claim 10, the claim recites a method for maintaining operation of a storage array network system, comprising: submitting a command to a primary array controller module and a secondary array controller module; performing a handshaking protocol between the primary array controller module and the second array controller module to determine which of the primary and the second array controller modules is to process the command; removing the command from a queue of the secondary array controller module; and timing of an aspect of the command. The claim rejected based on the same rationale as of claim 1. Sawdy, Rauscher, Cruyninngen do not expressly describe the claim's detail of the handshaking protocol. However, Workman describes a handshake protocol on the heartbeat path between the first and second storage controllers to determine which of the first and second storage controllers to process the command (Workman's page 3 paragraphs 30-31; Fig 2). It would have been obvious to one of ordinary skill in the art at the time of invention to include the heartbeat signals as suggested by Workman in Sawdy's system to monitor and determine if a switch over is required (Workman's page 3 paragraph 30 lines 16-23).

Sawdy, Rauscher, Cruyninngen, Workman do not expressly disclose the claim's aspect of a command queue. However, Jantz describes separate queues containing pending commands for each I/O paths A, B. In the situation of a failure on the first I/O path A, the command is executed and removed from the alternated queue of path B (Jantz's column 7 lines 5-35). It would have been obvious to one of ordinary skill in the art at the time of invention to include the command queues as suggested by Jantz in Sawdy's system so that the I/O pending requests can be rapidly identified and restarting all such identified I/O requests on the alternate good I/O path. (Jantz's column 7 lines 28-35).

As in claims 11-12, the claims recite wherein the step of performing a handshaking protocol includes the substeps of, if the primary array controller module is able, sending a primary module ready signal to the secondary array controller module; if the secondary array controller module is able, sending a secondary module ready signal to the primary array controller module; and if the primary array controller module is able, processing the command before an expiration of a given time (claim 11); wherein the step of performing a handshaking protocol includes the substeps of if the primary array controller module is able, sending a primary module acknowledge signal to the secondary array controller module upon receipt of the secondary module ready signal (claim 12). The claim rejected based on the same rationale as of claim 10.

As in claim 14, the claim recites wherein the step of performing a handshaking protocol includes the substep of disabling ports associated with a drive tray bank associated with the primary array controller module. Sawdy column 2 lines 40 to column 6 lines 35 clearly describes

a cable failure situation in which the surviving controller will assuming all devices of the failing

controller; thus the ports that being assigned to the failure controller will be disabled.

As in claim 15, Sawdy does not describe the claim's detail of successfully handshaking.

However, Workman describes wherein if the primary array controller module successfully

handshakes with the secondary array controller module within a given time, the primary array

controller module processes the command (Workman's Fig 2: #104 yes).

As in claims 16-17, the claims recite wherein if the secondary array controller module

unsuccessfully handshakes with the secondary array controller module within a given time, the

secondary array controller module processes the command (claim 16); wherein when the timing

reaches a time limit, processing of the command is performed by the secondary array controller

module (claim 17). Sawdy does not describe the claim's detail of unsuccessfully handshaking.

However, Workman describes the second storage device takes over the operation when the

heartbeat signal failures (Workman's page 3 paragraph 35).

As in claim 18, the claim recites wherein the time limit is measured from a time of

transmission of the command from a host. Sawdy does not describe the claim's detail of Sawdy

does not describe the claim's detail of time limit. However, Workman describes the algorithm is

based on if commands from the host operate normally in the first storage node (Workman's page

3 paragraph 30 lines 1-7).

As in claim 20, Sawdy describes wherein redundancy and drive control is accomplished

through multiple storage array controller modules (Sawdy's Fig 2). Claim 21 rejected based on

the same rationale as of claim 9.

As in claim 22, the claim rejected based on the same rationale as of claims 10,13.

As in claims 23-24 the claim recites wherein both the primary and secondary array controller modules are in active active mode (claim 23); wherein one of the primary and secondary array controller modules is in standby mode (claim 24). The rationale in the rejection of claim 22 is incorporated herein. Jantz further describes his multiple queues structures are operable in active controllers mode (Jantz's column 1 lines 45-55). Jantz's method of providing a separate queue or path B that contains identical commands as in the queue for path A would works equally well for dual controllers in standby mode.

Claim 25 rejected based on the same rationale as of claim 14.

Claim 26 rejected based on the same rationale as of claim 20.

Claim 27 rejected based on the same rationale as of claim 9.

Claims 19,21 rejected under 35 U.S.C. 103(a) as being unpatentable over Sawdy et al (US 6351831), Rauscher (US 6874100), Cruyningen (US Pub 2002/0019897), Workman et al (US Pub 2004/0068591), Jantz (US 5944838) as applied to claim 18, and further in view of Ito et al (US 2003/0014600).

As in claims 19, the claim recites wherein the command is transmitted from the host through an interface switch to the primary and secondary array controller modules. Sawdy, Rauscher, Cruyningen, Workman, Jantz do not expressly disclose the switch between host and storage controllers. However, Ito describes such a topology wherein multiples hosts are connecting to multiples storage controllers using switches (Ito's Fig 1, Fig 10). It would have been obvious to one of ordinary skill in the art at the time of invention to include the switches as

suggested by Ito in Sawdy's system thereby allowing host computers connect to devices using

multiple paths.

Claim 21 rejected based on the same rationale as of claim 9.

Response to Arguments

Applicant's arguments in response to the last office action has been fully considered but

they are not persuasive. Examiner respectfully traverses Applicant's arguments for the following

reasons:

As to the remarks on pages 7-8 concerning the claim 1, Applicant argues that Rauscher

does not disclose the claim's limitations of "..if the second storage array controller module does

not receive a signal from the first storage array controller module within a given period of time,

the second storage array controller module asserts control over the array of storage devices".

Rauscher's column 56-68 discloses a storage system comprises of two storage arrays being

configured in an active/active RAID system. Both storage array control modules further

communicate with each other vie a well known signal "heartbeat". By definition, the heartbeat

signal is communicated periodically such that if one storage system does not receive the

heartbeat signal from the other within a time period (i.e heartbeat signal's time period), it means

the other redundant storage system is failure. Therefore, the remaining storage controller will

take over entire storage system (see Rauscher's column 2 lines 8-15).

In contrast with Applicant's own conclusion that the failure of the heartbeat signal would

not motivate other not to operate with a heart beat signal. Rauscher's column 2 lines 62-67

further teaches that the failure of receiving a heartbeat signal indicates that the other redundant

storage system is failure, by providing separate power supply boundary to each side of the

storage system (see Rauscher's column 3 lines 1-16). Therefore, the failure of one side of the

redundant system does not disable the entire RAID system or cause data loss (Rauscher's column

3 lines 5-10). Thus Rauscher clearly teaches that the heartbeat signal must be used to detect the

failure of components in one side storage of a redundant storage system.

Per Applicant's arguments on pages 8-10 for claims 10-12,14-27, Examiner notes that

Applicant does not point out specifically errors in references' features being used to reject claims

1-12,14-27.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time
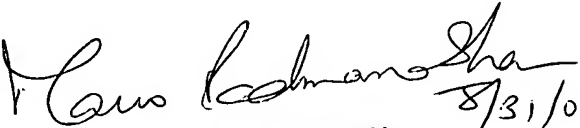
policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE

MONTHS from the mailing date of this action. In the event a first reply is filed within TWO

MONTHS of the mailing date of this final action and the advisory action is not mailed until after

the end of the THREE-MONTH shortened statutory period, then the shortened statutory period

will expire on the date the advisory action is mailed, and any extension fee pursuant to 37

CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

however, will the statutory period for reply expire later than SIX MONTHS from the mailing

date of this final action.

When responding to the office action, Applicant is advised to provide the examiner with the line numbers and page numbers in the application and/or references cited to assist examiner to locate the appropriate paragraphs.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Duc T. Doan whose telephone number is 571-272-4171. The examiner can normally be reached on M-F 8:00 AM 05:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mano Padmanabhan can be reached on 571-272-4210. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MANO PADMANABHAN
SUPERVISORY PATENT EXAMINER